in the cases where the plant was less than one foot in diameter at the ground, and they do not become a conspicuous feature until the tree is nearly adult; i.e., until it has attained a diameter of eighteen inches or more. At this stage of growth, if the crown be permanently wet, the knees become an extremely conspicuous feature, fifteen or twenty often being found grouped about a single stem at the distance of from five to twenty feet from the base of the bole. It thus appears tolerably certain that the need of having a portion of the roots above the water-level will be found in certain other trees. Thus far my note-books supply me, however, no certain indications of this fact. Indeed, it is only in the case of *Taxodium* and the tupelo that I have found the plants under circumstances which would show clearly their needs in this respect.

There is another feature concerning the growth of water-loving trees, or at least those which are tolerant of permanent moisture, that deserves attention. I have reference to the form of the bole or trunk as it is exhibited in the specimens of the Southern species, which occupy situations diversely affected by moisture. On very wet ground the trunk appears to be generally expanded at the crown, in a measure, which is not the case in specimens of the same species growing in dryer situations. Thus, in the cypress, we not infrequently find the bole at the crown, and for some feet above, having a diameter twice as great as it is at ten feet above the surface. Where, however, the tree grows on a dryer soil, the expansion at the base is much less considerable. The same appears to be the case in the tupelo, which often has a remarkable expansion of the trunk near the surface of the ground, where the plant occupies very wet situations. In a somewhat less degree, this feature appears to exist in all our trees, except the willows, which occupy sites characterized by diversity in the measure of wetness. I should state that this opinion rests entirely on eye-measurements. I have long intended to submit the impression to the criticism of a careful determination, but have not been enabled to do so. The impression has, however, been so often repeated to me in different regions, that I am inclined to believe there is little chance of error in the statement. I trust that some one who is well placed for such observations will subject the suggestion to a careful statistical inquiry.

If I be correct in the opinion that trees in very wet situations develop an enlarged bole near the surface of the ground more frequently than those which occupy dryer situations, we may perhaps account for the fact in the same way in which I am disposed to explain the occurrence of knees in *Taxodium* and of root-loops in the tupelo; viz., through a need of an aeration of the sap, which is denied in roots that are under water.

It appears to me from eye-observation, as yet uncorrected by measurements, that the buttresses which the water-loving trees form about the trunk are more considerable than they are in the same species on higher land. If this be really the case, it may perhaps be due to the same physiological need which has led to the formation of knees, and to the enlargement of the bole near the crown of the tree. I feel less confident as to this increase in the buttress prominences than I do concerning another observation which I have above set forth. I state the impression for the reason that it has very frequently been borne in upon me in my studies on the development of swamp-plants. At first I was disposed to attribute the peculiarity to the fact that the roots of swamp-trees do not usually extend far beneath the surface, and therefore the buttresses were enlarged in order to give greater stability to the trunk. This hypothesis was disproved by the fact that trees growing in such situations are very rarely uprooted by storms. I failed, indeed, to find a single case of such uprooting by the action of the wind in several thousand miles of journeys through the morasses in the eastern part of the United States. The only cases in which such overturning met my eye appeared in the swamps near the Mississippi, which, on the whole, exhibit buttress structures much less conspicuously than the trees of the Atlantic coast morasses.

There is another interesting series of facts connected with the effect of excessive water on our forest-trees which are tolerant of swamp conditions. These relate to the variations in the character of the bark, the mode of branching, etc., of the plants in situations diversely conditioned as regards the amount of moisture. In almost all our forest-trees, which range from dry to very wet stations, there are noticeable diversities as regards the above-mentioned features, according to the station they occupy. Thus the ordinary chestnut oak varies in a very noticeable manner between dry ground and wet. The tree in very wet situations has a much smoother bark than it exhibits on high land, and I am told by the woodmen that this bark in trees which grow within the swamp is unfit for the purposes of tanning. The variety of tupelo known to the woodman of the Dismal Swamp as the "pawpaw gum," appears to owe its peculiarities to the fact that it normally grows in much wetter localities than the ordinary *Nyssa*. It differs from the parent species in that the bole is singularly enlarged near the crown, often having a diameter for some feet above the surface of the water two and one half times as great as it has at the height of ten feet above the ground. In this connection it may be noted that this variety of the tupelo is less disposed to develop the root-loops than the more common form, it appearing indeed as if the great extension of the bole near the crown made the development of these processes unnecessary.

The variation in the character of our forest-trees when exposed to swamp conditions affords an extremely interesting field for an important class of inquiries concerning the influence of environment, and the effect of natural selection, on the development of organic forms. In the Dismal Swamp, where the water-level during the growing season is subject to relatively little variation, a difference in altitude of six inches, or at most a foot, will greatly affect the character of the timber-trees and other plants. With each such variation in height, we perceive a noteworthy change in the character of the vegetation.

MENTAL SCIENCE.

Statistics of Visual Images.

THE American Society for Psychical Research has devoted considerable time to the study of unconscious mental habits, — a field that abounds in suggestions applicable to the class of phenomena which such a society investigates, but is still more valuable as contributing to our knowledge of obscure mental traits. Thus Professor C. S. Minot has shown that we are by no means as likely to think of one number as of any other, when simply asked to think of a number, but that there exist certain definite and very general preferences for certain numbers above others. People have "number-habits," or unconscious tendencies to choose a certain few numbers (perhaps on account of greater familiarity, easy manipulation, peculiar association, brevity of utterance, or other causes) when an unlimited choice is offered them. In No. 4 of the "Proceedings of the American Society for Psychical Research," Professor Minot brings together extremely interesting material for a similar study with reference to the "diagram-habit." The committee on experimental psychology of this society sent out a large number of postal-cards bearing the printed request, "Please draw ten diagrams on this card, without receiving any suggestion from any other person, and add your name and address." Five hundred and one such cards have been collected, of which 310 were drawn by men, 169 by women, and 22 had no name.

The first point of interest in such a study is to observe how various the drawings of five hundred persons will be. We are not told how many different designs occurred; but the occurrences of 83 different designs have been tabulated, and their sum includes about half of all the drawings. But the real poverty of the intellect when it expresses itself naturally is made evident by the great preponderance of a very few simple diagrams. Thus circles were drawn 209 times; squares, 174 times; equilateral triangles, 160 times; crosses, 160 times; letters of the alphabet, 82 times; diamonds, 80 times; oblongs (horizontal), 78 times; inscribed circles, 78 times; stars, 77 times; faces (profile to the left), 61 times; houses, 56 times; rhombi, 56 times; scrawls, 53 times; other animals and heads, 48 times; flowers, 46 times; leaves, 45 times; hexagons, 42 times; cubes, 42 times; right-angled triangles, 42 times; figures of men, 32 times; and so on. The above are the twenty most frequent drawings, and, it will be seen, form an aggregate amounting to nearly one-third of all the drawings. On the average, each occurs 80 times. If we group to-

gether the designs belonging to the same natural class, we find, of circles, both plain and with inscribed figures, 287; of squares, both plain and with inscribed figures, 236; of triangles, equilateral and otherwise, 220; of four-sided figures, 245; the sum of which four classes is 988, or nearly one-fifth of all the drawings. In other words, if a person is about to draw the first ten designs that come to his mind, it is a pretty safe prediction that two of the ten will be either a circle, a square, a triangle, or a quadrilateral.

Tabulation upon another basis reveals the fact that 2,344 diagrams were drawn exclusively with straight lines, and 1,337 diagrams with less than six straight lines; that 681 diagrams were drawn exclusively with simple curved lines, and 603 diagrams with less than six such lines. One is more than three times as apt to draw a diagram composed of straight lines than one composed of curved lines. Among the non-geometrical designs, animals, plants, and manufactured objects include by far the most frequent drawings. Men are drawn 32 times; hands, 10 times; flowers, 46 times; leaves, 45 times; and trees follow with only 14 times; houses are drawn 56 times; and the next figure under this class is 15 for books.

Furthermore, without any express implication in the request, the respondents have taken it for granted that ten different designs were wanted, and very few repetitions of designs occur. If the number of persons drawing each kind of design be tabulated, it reenforces the conclusion suggested by the original tabulation as to the limitations of the mind when acting as it does in these tests. 40 per cent of the respondents have drawn circles; 34 per cent, squares; 31 per cent, equilateral triangles; 25 per cent, crosses; 16 per cent, diamonds, etc.; and there are very few designs drawn by only one person.

What this research especially impresses is the lack of individuality in our off-hand mental products. As Dr. Minot well puts it, "We too easily forget our similarity, and forget that it stretches over trifling habits as well as over the great and little modes of thought. We feel, and for the most part willingly acknowledge, the likeness of our natures, but our sentiments and ideas we are over-inclined to consider original. Such tests as the drawing of the diagrams thrust home the conviction that even in trifles we differ very little. The images and notions which pass across the consciousness of each individual are almost all common property: they are comparable to coins, — every one is a separate entity, but yet the stamp is the same. Our thoughts are in a large measure owned by the community: we are in mental matters all pure communists."

There are other questions upon which these results shed interesting light. The first is the order in which one is apt to draw, and by inference to think of, the several designs. One would suppose that the designs occurring most frequently would also be the ones first thought of. The results, however, do not reveal as close an agreement as one would expect. They show that an equilateral triangle is more apt to be found among the first diagrams than any other figure. Then come squares, then right-angled triangles, then circles, then faces not in profile, then faces with profile to the right, then diamonds, then oblongs, and so on. It is possible that the order of frequency of diagrams occurring the very first of the ten would be more in agreement with the order of general frequency. Another interesting comparison is between the designs furnished by the men and by the women. Remembering that we have nearly twice as many records of the former as of the latter, we find that men have more than their share of circles, both plain and inscribed, of rhombi, of scrawls, of men, and of right-angled triangles, while women are fonder of squares, equilateral triangles, letters, diamonds, stars, faces, flowers, and so on. "That gentlemen preponderate with hearts, and ladies with hands, perhaps may seem to many a natural consequence of our social conditions;" and other of the preferences seem to have a natural basis. That many of them must be regarded as accidental is doubtless to be admitted. The general law, however, is that there is much more repetition, and thus much less variety, among women than among men.

A few residual points should be noted. Some of these designs are undoubtedly to be traced to the existence of a "form" in the mind towards which a person may persistently tend. The "number forms" so vividly described by Mr. Francis Galton may serve as a type of such habits. When toying with a pencil in one's hand, many persons will find themselves drawing over and over again a simple figure. This accounts for some of the very peculiar drawings furnished by some of the respondents, and testimony in favor of such "forms" could easily be gathered. The individual bent, the dominant interest, the "apperception," as the psychologist would term it, serves as another clew. "A painter recalls his palette; a naturalist, his butterfly; a physician, his skull; a college student, his bicycle; in a few cases the entire ten drawings seem to be taken from "professional" suggestions. Another class of drawings seem to have their origin in the surrounding objects, being really copies of objects seen at the time; but this is a small class, and most of the images are doubtless drawn from the resources of past experience. Finally, the drawings are almost all simple in character. We draw what is easiest. This is well shown in the prevalence of faces seen in profile to the left, of left-handed spirals, and so on: for these are easier to draw, and the corresponding designs inverted towards the right; that is, easier for right-handed persons. So that these predominances indicate at once the general right-handedness of mankind, and the tendency to draw what is easiest.

The practical application of these facts tells severely against the arguments supported by the English Society for Psychical Research in favor of thought-transferrence. Dr. Minot points out that in several series of experiments reported in their "Proceedings" the position has been assumed that one kind of card, of number, of simple figure, is as likely to be thought of as another, and has estimated the improbability of the recorded coincidences accordingly. All evidence in which such an assumption is used must be looked upon with suspicion; and only when the conditions of the experiments take full and complete account of this very universal tendency for minds to run in similar grooves when dealing with simple things, will it be time to consider the evidence in favor of any abnormal form of the communication of ideas.

COMMERCIAL GEOGRAPHY.

An Agricultural Map of North America.[1]

THE climatic conditions of North America are favorable to agriculture, except in the arid regions and in the extreme north. By the uncultivable region the agricultural land is divided into two parts of unequal extent, — the narrow Pacific coast strip, and the Atlantic region. East of the Rocky Mountains three zones of agriculture may be distinguished. The most southern one is that of subtropical cultures, reaching to the 37th degree of latitude; the central one is that of the culture of corn; and in the most northern zone wheat and oats are the principal products. On the Pacific coast there is no zone of subtropical cultures, but two zones only can be distinguished, — that of wheat, and that of oats. This fact shows that there is a marked difference between the Pacific and Atlantic regions. Two-thirds of the latter are used for the culture of subtropical plants, to which class corn belongs, while these are nowhere cultivated on the Pacific slope. This contrast is caused by the difference of climate, that of the wheat districts of California and Oregon being characterized by a uniform oceanic climate, with prevailing precipitations in winter, and dry summers; while the cotton and corn regions of the Atlantic side have a continental climate, with abundant precipitation during the warm seasons. Only the oats regions on the Pacific and Atlantic sides are analogous, the climate being characterized by a low temperature of summer and sufficient precipitation.

While the dampness and heat of the Atlantic summer favor the cultivation of subtropical plants more than in any other country, the sharp contrasts of summer and winter prevent the successful cultivation of plants of the southern temperate zones, especially that of the vine, oranges, and lemons, which require a spring with slowly rising temperature and moderate precipitation.

On the accompanying map the extent of each culture has been laid down according to the results of the tenth census, the percentage of area of land occupied by each culture being inserted in a large-scale map, of which the present sketch-map is a reduction.

[1] According to Max Sering, Die landwirthschaftliche Konkurrenz Nordamerikas.